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ABSTRACT

Bennett College (North Carolina) has developed the use of an Integrated Computerized Instructional Support System (ICISS) featuring the use of large networked test-banks, a sophisticated test management system, application software, and multimedia. These materials are used both for interactive learning experiences in the classroom and for practice, drill, and tutorial in the computer laboratory. The system involves students in the learning process by providing interactive questions from the test-bank and visual presentation of concepts. The integration of test-banks for computer-based testing, textbooks, and electronic lecture notes allows the delivery of a variety of teaching methods and caters to a variety of learning styles. The ICISS has been set up on local area networks in two computer classrooms so that a variety of teaching/learning approaches can be used. Direct lecturing, writing on the board, class discussion, and seat work are combined with computer drill and practice and class projection of multimedia lecture materials. Learning lab activities and individualized use of these materials round out the entire teaching/learning package. At Bennett, the main use of the materials has been in teaching a variety of first- and second-year mathematics courses. (AEF)

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An Integrated Computerized Instructional System for Classroom and Lab

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Bennett College has developed the use of an integrated computerized instructional system featuring the use of large networked test-banks, a sophisticated test management system, application software, and multimedia. These materials are used both for interactive learning experiences in the classroom and for practice, drill, and tutorial in the computer laboratory. The system involves students in the learning process by providing interactive questions from the test-bank and visual presentation of concepts. Thus far the materials have been used mostly in first-year courses where specific information and techniques for problem-solving are emphasized.

The integration of test-banks for computer-based testing, textbooks, and electronic lecture notes in first-year courses allows the delivery of a variety of teaching methods and hence caters to a variety of learning styles. The system is not complicated, nor does it require that the use of Internet and sophisticated software and program development, but it is effective. At Bennett College, it is used on local area networks in two computer classrooms, with about thirty computers and a projection system in each. An integrated computerized instructional system (ICISS) has been set up in both labs so that a variety of teaching/learning approaches can be used. In the classroom direct lecturing, writing on the board, class discussion, and seat work is combined with computer drill and practice, and class projection of multimedia lecture materials. In addition learning lab activities and individualized use of these materials round out the entire teaching/learning package.

At Bennett, the main use of the materials has been in teaching a variety of first and second year mathematics courses. Currently the package of materials is also available in first-year chemistry and biology. These multimedia materials are produced by EDUCO International, Inc. of McDonough GA. In other disciplines multimedia software is often available on the market from textbook publishers. While the integration of topics among the textbooks, test-banks, and electronic lecture notes is convenient for the student and the lecturer, it is not crucial. What is distinctive and significant is the computerized set of practice/test questions with hints and solutions.

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INTEGRATED COMPUTERIZED INSTRUCTIONAL SUPPORT SYSTEM

The Integrated Computerized Instructional Support System was developed by Dr. Man Sharma, at Clark-Atlanta University. This project has been supported by several grants from the US Department of Education through the Minority Science Improvement Program. Materials are distributed by EDUCO International, Inc. McDonough GA. Approximately 100 institutions are using or have used these materials. Bennett College has been involved with the ICISS project since 1988.

Question Banks and the Graphics Editor

The first component of the system is a set of extensive multiple-choice test-banks for each course. Most of the questions have hints and solutions so that students can use the test-banks for tutorials outside class or they can be used for short timed quizzes during the class period. Such frequent short quizzes are particularly useful in courses such as elementary algebra or foreign languages where quick recall of facts and procedures are tested. Students who do not do well on the first try may be allowed to make up the quiz at the discretion of the instructor. The questions banks have been installed on the network and records of the students' scores on quizzes are kept in "result" files. The instructor can also generate multiple versions of the test to be printed out and used as hard-copy tests. These can be saved as a text file and modified. A graphics editor (MEDIT.EXE) with many mathematical symbols available is used to add questions or modify questions in the test-banks.

The use of these tests as practice and then for quizzes is a valuable feature, particularly when learning the basic skills and facts of the content of a course. Since the questions of the testing system are multiple choice, the types of questions that can be asked are limited. However, the capability to include hints and complete solutions greatly bolsters the use of the materials for practice. Short-answer printed tests can easily be created, as indicated above, by modifying the text-file tests by deleting the multiple choices and leaving sufficient blank spaces for the student to write out the answer.

Crucial to the system is the development of a large set of questions with several similar versions. This can be done over a period of time as tests and final exams are routinely prepared. Questions are chosen by a set of codes and by randomization.

File Management and the Test / Menu Generator

An 8-digit coding system is used and this allows the instructor to select the types of questions selected at random by the computer. Usually the coding system has the form:

<Course Chapter Section Concept Question No (2 digits) Version Number (2 digits).>

Hence a question with code 21323003 represents the second course (e.g, Elementary Algebra, Biology 102), chapter 1, section 3, topic 2, question 30, and version 03. A practice test consists of a collection of four digit codes, so that the instructor can select questions within a particular topic, but the questions and versions are selected at random for presentation to the student.

The ICISS system includes several programs that support the testing/tutorial process. It is not necessary that the instructor knows how to use these programs, but the laboratory technician will need to spend some time learning the procedures. A file management program (FMS) helps in the management of the question banks, by indexing the questions, checking technical errors, and creating various subsets and summaries of the test-banks. A single program (MENUGEN) is used to generate the individual tests and to create the menu which is displayed when students come for practice and quizzing. When the a student takes the test, one of the many questions with the appropriated 4-digit or 6-digit code is selected at random. With a suitably large test bank, the students can practice several times and will see relatively few questions twice. The instructor can "activate" tests for selected periods of time. An electronic class roll prevents unauthorized students from taking the test.

When MENUGEN is run, a list of possible actions is shown. To create a practice test, one

version of each 4-digit question is displayed and the particular questions to be included in the practice can be selected. Likewise to create a quiz, one version of each 6-digit question is displayed. When the process of creating a test is completed, the codes for the test are saved and the test is added to the test menu for the student.

As indicated above, tests may be prepared for students on two levels: review questions with no score and quizzes for which the score is saved. For the review questions (called practice tests), students may practice any number of times and each time different questions will be provided, depending on the number of similar versions in the test-bank. The time spent on the test is recorded but the score is not. Hence the students may work on questions and study the hints and solutions without worrying about the stigma of getting a low grade.

When the student takes the review test (tutorial), hints and solutions are provided, and the student gets immediate feedback. An actual quiz consists of a collection of six digit codes, so that the instructor can select specific types of questions; the only difference between the tests for one student and another is the version of the question. The degree of difficulty of the same quiz given to different students will be the same. Moreover, the amount of time allowed to complete the test is specified in setting up the quiz. When a student takes an actual test, answers can be changed as on a paper test, but the student will not be able to review missed questions and look over the solutions until he or she finishes the test. If the instructor wishes to see the student's work while taking a test on the computer, the student can be directed to show work on paper while taking a test on the computer. The computer simply provides questions easily and conveniently.

Course Management System, Record Management System, and Item Analysis

The Course Management System (CMS.EXE) produces an electronic grade book, so that scores can be entered into the grade book quickly and easily directly from the file server. This is a powerful feature for large classes. This automatic transfer feature saves a great deal of time for classes, provides complete accuracy in recording scores, and allows for frequent short quizzes. Besides electronic transfer of scores on tests to the class roll, the course management system allows for manual entering of grades, a wide variety of methods to determine grades, and periodic progress reports to students. These periodic progress reports have proved popular among the students, since the reports indicate to the students exactly where they stand in the class and allow the students to make corrections if some scores are inaccurate. Another program provides an item analysis of the test results for each type of question.

Electronic Lecture Notes

Electronic Lecture Notes have been installed for Basic Mathematics, Beginning Algebra, and Pre-calculus (including College algebra and Trigonometry). Chemistry and Biology Notes are also available for first-year college courses. The electronic lecture notes, (also known as EDUCO Electronic Tutors) are based on Asymmetric's Toolbook. They provide extensive use of dynamic graphs, animation, attractive screen designs, and colorful display of concepts and strategies for solving problems. (See examples of typical screens at the end of these notes). Textbook publishers are often including similar multimedia materials to the instructor upon the selection of a textbook, and commercial materials are available, sometimes with a substantial price tag. Text and diagrams

are presented a little bit at a time, and the student can "click" on various links or proceed in a step-by-step manner. Examples are worked out in detail with explanations, again one step at a time. The electronic lecture notes can be used by the instructor for display to the entire class as a substitute for the chalk and talk approach. They are particularly effective when animation or visualization is required. Use of the electronic lecture notes allows teachers to stay well organized and informed and to reduce time spent in writing on the board. Since the electronic lecture notes are available to students after the class is over, the students can concentrate on the discussion and do not need to take notes. Electronic Lecture Notes allow the instructor to present a variety of kinds of activities in class. I use them in place of lecture for twenty or twenty-five minutes once or twice a week.

The electronic lecture notes can also be used by students in the computer lab as tutorials complementing class lectures. If a student misses a class, she or he can easily make up the work by using the software. The material corresponds to text book materials. They can also be used as enrichment for material not covered in class for the advanced student. Guided instructions for students to use the electronic lecture notes can be prepared and distributed. These instructions can indicate in detail what the students should cover on the computer, ask them to write down the basic results and examples shown, and direct them to work problems similar to those displayed. This approach is particularly useful when the instructor is away from campus or after a quiz. In the latter situation, these guided instructions are used when students finish at various times and can begin studying for the next topic while others finish the quiz.

Conclusion

Much of the education hype today is directed to the use of the Internet for the new focus in teaching, sometimes exclusively. At the same time, many instructors continue to teach in traditional ways, writing notes on a blackboard and lecturing without technology. The narrative above tries to show that one does not have choose between the chalk-and-talk methodology and the telecomputing methodology but can and should mix a variety a teaching strategies involving lecture and discussion, electronic lecture notes or other visual materials with a projection system, and individualized tutorials and explorations on the computer as part of classroom and learning lab activities. The software packages, particularly the ICISS programs, provide powerful but simple tools for practice and drill, tutorials, and multimedia materials. Students who need support appreciate the chance to practice and to receive help. It is not difficult to place these materials on a local area network.. The combination of materials allows the students to take a great deal of control for their own learning, and this should be one of the goals of any educational program.

References

ICISS Software, textbooks, and the Electronic Tutor Version 2.0 (which includes courses in Basic Mathematics, Algebra Part I (Elementary Algebra), Pre-calculus, Calculus I, Calculus II, Calculus III, General Chemistry, and General Biology) are available from EDUCO International Inc., 1948 Chambers Rd., McDonough GA 30352. Phone 1-800-963-3826, FAX 1-770-954-9060.

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